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PERFORMANCES ON GROWTH AND RHIZOME SIZES OF TURMERIC (*CURCUMA LONGA* L.) VARIETIES, GROWN UNDER CONVENTIONAL AND ORGANIC NUTRIENT MANAGEMENT PRACTICES UNDER TERAI REGION OF WEST BENGAL

DEBOJIT BASAK[1] & JAGADISH CHANDRA JANA[2]

[1]*Department of Vegetable and Spice Crops, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India*

[2]*Department of Vegetable and Spice Crops, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India*

ABSTRACT

Eleven improved varieties of turmeric (Megha Turmeric (V_1), Alleppy Supreme (V_2), IISR Kedaram (V_3), IISR Pratibha (V_4), BSR-2 (V_5), Suranjana (V_6), Rajendra Sonia (V_7), Roma (V_8), Rashmi (V_9), Duggirala Red (V_{10}) and Narendra Haldi-1 (V_{11}) were examined in a field experiment during rainy season, 2012-13 (Season May-March) to study the comparative effect between conventional nutrient management practices (P_1- inorganic N:P:K @ 120:60:60 kg/ha (RDF) + FYM @15 tonnes/ha) and organic nutrient management practices (P_2- FYM @ 15 tonnes/ha and vermicompost @ 7.5 tonnes/ha + Azophos @5 kg/ha) for the growth characters, finger physique etc. The study was carried out at Organic vegetable Production Field of Uttar Banga Krishi Viswavidyalaya with 2-factor statistical randomized block design. The treatment P_1 over P2 and the individual varietal performances significantly differed from each other for all growth characters like plant height, number of tillers per plant, number of leaves per plant, leaf length and leaf width and finger size attributes like mother and primary rhizome length and perimeter. The interactions between varietal performance and the production system for the growth and finger size characters also differed significantly except leaf width, mother rhizome length and primary rhizome perimeter.

KEYWORDS: Organic, Nutrient Management, Turmeric Fingers, Growth, Size

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Original Article

INTRODUCTION

Turmeric botanically known as *Curcuma longa* L. belongs to the family *Zingiberaceae* is one of the most important and ancient spices of India and a traditional item of export, which is used daily by all classes of people in the preparation of tasty curried dishes and as an ingredient of medicinal preparations. Turmeric is being an exhaustive and long duration (8-9 months) crop, responds well to nutrition. Besides different factors, optimum dose of nutrients is essential in improved package of practices which can play a key role in increasing the growth and yield. Generally conventional practice implies integrated use of inorganic fertilizers and organic manures with normal agronomic practices, which is dominating the farmer's field traditionally. As we know, organic cultivation is eco-friendly and less harmful for our health, the consumer demand for organically grown turmeric is markedly increasing all over the world for export market (Mohan *et al.*, 2013). Despite, the organic production system is designed to work constructively with natural biological cycles and to operate with minimal external non-renewable inputs, several facts like non-availability of sufficient and certified organic inputs, high price of the organics, non-

uniformity in production etc. and most importantly, the required long term effort throwing continuous challenges to the farmers and suppresses the reason of acceptance to adopt sole organic practice some extent (Friedrich & Kassam, 2009; Derpsch, 2007). One of the major challenges in turmeric growing is to produce good quality of finger propagules. It has also been found that the crop yield is significantly affected by seed rhizome (Hailemichael and Tesfaye, 2008). Hence, the present study was carried out with a view to have a comparative study of the effect of organic nutrients management practice and conventional nutrient management practices on crop performance with respect to crop growth and finger size.

MATERIALS AND METHODS

The field experiment was conducted at the Instructional organic field of UBKV, Pundibari, Cooch Behar of the state West Bengal during the season of May-March of 2012-13. The site is located at 43 m above mean sea level with 89°23′53″ E longitude and 26°19′86″ N latitude. The soil was of sandy loam type having pH of 5.74, organic carbon content 0.85% and available Nitrogen, Phosphorus and Potassium, were 170.85 kg/ha, 18.29 kg/ha and 120.45 kg/ha respectively. The experiment was carried out in a two factor randomized block design with three replications, where organic and inorganic plots having similar soil properties and were situated 5 m apart from each other and were separated by a *Dhaincha* live hedge to protect any possible contamination. The experiment constitutes eleven varieties (Megha Turmeric (V_1), Alleppy Supreme (V_2), IISR Kedaram (V_3), IISR Pratibha (V_4), BSR-2 (V_5), Suranjana (V_6), Rajendra Sonia (V_7), Roma (V_8), Rashmi (V_9), Duggirala Red (V_{10}) and Narendra Haldi-1 (V_{11}) and two treatments, viz. conventional (P_1), *i.e.* recommended full dose of FYM (15 tonnes/ha) plus recommended full dose of NPK fertilizers (120:60:60 kg/ha) and the other treatment is organic (P_2), *i.e.* 15 tonnes of FYM per hectare plus vermicompost @7.5 tonnes/ha with *Azophos* @5kg/ha. The each finger propagules were of 40-50g and having at least 3 internodes. The treatments under organic cultivation received well decomposed FYM and vermicompost as source of nutrient two weeks before sowing. Quantity of FYM required for different treatments was calculated on dry weight basis and total nitrogen content of manure used, which ranged from 0.90 to 1.10%. In P_1, the recommended dosage of N: P: K @ 120:60:60 kg/ha was given in form of inorganic fertilizers in two equal splits doses for N and K (as basal and side dressed after thirty days of sowing) and entire amount of P was applied as basal dose. Farmyard manures applied in organic treatments was enriched with *Azophos* before field application. Organic plant protection was taken up using Neem seed powder extract, Neem and *Pongamia* soap (0.7%) for biotic stress management. For recommended inorganic plant protection, chemicals were used based on necessity. The crop was harvested as per maturity commences. The observation on crop growth parameters and rhizome parameters (with the help of thread and scale) were recorded and STATISTICALLY analysed with the help of INDOSTAT statistical package (version 7.00, Hyderabad, India).

RESULTS

The highest value (128.14 cm) for plant height in Narendra Haldi-1 was found under conventional nutrient management practice (Table 1). Narendra Haldi irrespective to the production system was found best for plant height (125.61 cm). Significantly highest tiller number per plant (4.17) was found in the var. Suranjana under conventional nutrient management and the variety also showed significantly higher value for number of leaves per plant (8.55). Highest Leaf length (93.62 cm) and highest leaf width (14.83 cm) was found in the variety Kedaram under conventional nutrient management. The interaction between production system and varietal performance for leaf width was found to be non significant.

From the Table 2 it was found that highest mother rhizome length (9.20 cm) was produced by the var. Suranjana and the var. Narendra Haldi-1produced highest mother rhizome perimeter (13.31 cm) under conventional nutrient management practices. The highest value (9.37 cm) for primary rhizome length was produced by the var. Rajendra Sonia while highest primary rhizome perimeter was obtained from the var. Suranjana, as varietal performance respectively. The data also shows that the interaction between the production system and varietal performance had no significant effect for mother rhizome length and primary rhizome perimeter.

DISCUSSIONS

Growth parameters showed significant difference towards the results obtained from different production systems. Application of organic manure and inorganic fertilizers is indispensable as their conjunctive use stimulates the mineralization of nitrogen and diminishes the fixation of phosphorus and potassium in the acidic soils and thus might have enhanced vegetative growth. These results are in conformity with the findings of Gayathri and Reddy (2013), where the beneficial effect of application of organic manures along with inorganic fertilizers increased the vegetative growth of plant can be attributed to the synergistic effect of organic manures in making available more plant nutrient by improving the soil physical condition and solubilising the nutrients in soil. The varieties, Suranjana (check variety of the locality), Narendra Haldi-1 and Kedaram was found promising for growth attributes. That was might be because of the environment effect which could have triggered the phenotypic expressions.

Turmeric consists of mother rhizome, primary rhizomes, secondary rhizomes and tertiary rhizomes, among which mainly mother and primary rhizomes are used as propagule (Nair, 2013) and these are determining factors for crop yield (Olojede et al., 2009). The Table 2 shows that in the experiment production system, varieties and their interaction had an undeniable significant effect for the different rhizome length and perimeters which collectively can be termed as size. Researches proved that inorganic nitrogen and potassium has a significant effect on finger size and the finger size is directly related to the yield of turmeric (Haque et. al., 2010). Besides, the integrated use of organic nutrients along with the fertilizers could have improved the soil physical properties and therefore nutrient availability and uptake might have increased which might have led to more translocation and storage of photosynthetic food in rhizomes which is a modified underground stem. This was in conformity of the findings of Oad et al., (2004) where it was found that integrated use of fertilizers and organic manure increases stem length and its girth.

CONCLUSIONS

Organic research tends to be more diffuse, farm-base participatory, drawing on local knowledge and tradition. Still the need for more concentrated research data for the prolonged organic cultivation of turmeric for culinary use as well as propagule can be felt. There is no doubt that organic nutrient management has undeniable effect on soil, plant and ecology, but on the basis of present context integrated nutrient management is more economically beneficial to the farmers, rather than sole organic nutrient management practice in respect to the growth parameters and size of the rhizomes, yield of crop, production cost and uniformity in produce.

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APPENDICES

Table 1: Performance of Different Turmeric Varieties under Different Nutrient Management Practice for Plant Height (Cm), Number of Leaves per Plant, Leaf Length and Leaf Width

Treatments	Plant Height (cm)			Number of Tillers Per Plant			Number of Leaves per Plant			Leaf Length (cm)			Leaf Width (cm)		
	(P_1)	(P_2)	Mean	(P_1)	(P_2)	Mean	(P_1)	((P_2)	Mean	(P_1)	(P_2)	Mean	(P_1)	(P_2)	Mean
Megha Turmeric (V_1)	117.77	113.16	115.47	3.47	3.33	3.40	8.47	8.13	8.30	84.04	83.83	83.93	12.35	12.05	12.20
Alleppy Supreme (V_2)	110.11	102.55	106.33	3.80	3.57	3.68	7.63	7.60	7.62	91.71	86.16	88.94	13.07	12.72	12.90
Kedaram (V_3)	125.33	115.86	120.59	4.03	3.80	3.92	8.40	7.13	7.77	93.62	86.91	90.27	14.83	13.80	14.14
Pratibha (V_4)	121.03	116.53	118.78	3.00	2.90	2.95	8.33	7.47	7.90	91.90	85.22	88.56	13.90	13.35	13.62
BSR-2 (V_5)	118.83	119.93	119.38	3.87	2.80	3.33	7.07	6.73	6.90	86.14	82.03	84.09	13.89	13.21	13.55
Suranjana (V_6)	123.46	117.80	120.63	4.17	3.93	4.05	8.80	8.30	8.55	92.48	87.94	90.21	14.64	13.53	14.09
Rajendra Sonia (V_7)	122.23	116.31	119.27	3.40	3.20	3.30	8.53	7.06	7.80	81.33	80.76	81.05	13.47	12.47	12.97
Roma (V_8)	124.88	121.08	122.98	3.20	3.03	3.12	8.43	8.03	8.23	78.64	77.50	78.07	12.84	12.37	12.60
Rashmi (V_9)	121.82	119.75	120.78	4.06	3.87	3.97	8.77	8.10	8.43	87.89	78.66	83.27	13.51	12.54	13.02
Duggirala Red (V_{10})	125.64	120.31	122.98	3.60	3.40	3.50	8.67	7.60	8.13	86.33	83.21	84.77	13.38	13.08	13.23
Narendra Haldi-1 (V_{11})	128.14	123.09	125.61	3.93	3.50	3.72	8.27	7.87	8.07	92.09	82.20	87.14	13.97	12.82	13.40
Mean	121.75	116.94	-	3.69	3.39	-	8.31	7.64	-	87.83	83.13	-	13.59	12.93	-
-	P	V	P x V	P	V	P x V	P	V	P x V	P	V	P x V	P	V	P x V
S.Em±	0.23	0.55	0.78	0.03	0.08	0.11	0.03	0.07	0.11	0.25	0.59	0.83	0.06	0.15	0.21
CD (P=0.05)	0.67	1.57	2.22	0.09	0.22	0.31	0.09	0.21	0.30	0.72	1.68	2.37	0.18	0.43	NS

- **P_1**: Conventional nutrient management (inorganic N:P:K @ 120:60:kg/ha (RDF) + FYM @15 tonnes/ha);
- **P_2**: Organic nutrient management (FYM @ 15 tonnes/ha and vermicompost @ 7.5 tonnes/ha + *Azophos* @5 kg/ha)

Table 2: Performance of Different Turmeric Varieties under Different Nutrient Management Practice for Mother Rhizome Length, Mother Rhizome Perimeter, Primary Rhizome Length and Primary Rhizome Perimeter

Treatments	Mother Rhizome Length (cm)			Mother Rhizome Perimeter (cm)			Primary Rhizome Length (cm)			Primary Rhizome Perimeter (cm)		
	(P_1)	(P_2)	Mean	(P_1)	(P_2)	Mean	(P_1)	(P_2)	Mean	(P_1)	(P_2)	Mean
Megha Turmeric (V_1)	8.28	8.16	8.22	12.82	11.62	12.22	8.01	7.65	7.83	5.87	5.80	5.84
Alleppy Supreme (V_2)	7.33	7.16	7.25	9.91	9.42	9.67	8.15	8.03	8.09	6.53	6.24	6.39
Kedaram (V_3)	8.78	8.12	8.45	13.01	12.62	12.81	9.27	8.05	8.63	6.63	6.48	6.56
Pratibha (V_4)	8.27	8.16	8.22	12.79	11.58	12.19	7.73	7.67	7.72	6.64	6.63	6.64
BSR-2 (V_5)	9.14	8.56	8.85	11.56	9.69	10.63	9.82	8.14	8.98	6.74	6.24	6.49
Suranjana (V_6)	9.20	8.85	9.02	13.22	12.67	12.94	9.00	8.81	8.91	7.36	7.25	7.31
Rajendra Sonia (V_7)	8.40	8.24	8.32	12.84	11.70	12.27	9.47	9.26	9.37	6.77	6.00	6.38
Roma (V_8)	8.33	8.23	8.28	12.66	11.39	12.02	8.19	7.75	7.97	6.64	6.26	6.45
Rashmi (V_9)	8.06	7.80	7.93	10.73	9.94	10.34	9.11	8.71	8.91	6.23	6.46	6.35
Duggirala Red (V_{10})	7.68	7.29	7.49	12.92	10.82	11.87	9.40	9.26	9.33	6.39	6.29	6.34
Narendra Haldi-1 (V_{11})	7.72	7.55	7.64	13.31	12.79	13.05	8.26	7.66	7.96	6.78	6.71	6.74
Mean	8.29	8.01	-	12.34	11.30	-	8.76	8.27	-	6.60	6.40	-
-	**P**	**V**	**P x V**	**P**	**V**	**P x V**	**P**	**V**	**P x V**	**P**	**V**	**P x V**
S.Em±	0.04	0.10	0.14	0.05	0.12	0.18	0.07	0.15	0.21	0.07	0.16	0.22
CD (P=0.05)	0.12	0.28	**NS**	0.15	0.35	0.50	0.18	0.43	0.61	0.19	0.45	**NS**

- **P_1**: Conventional nutrient management (inorganic N:P:K @ 120:60:kg/ha (RDF) + FYM @15 tonnes/ha);
- **P_2:** Organic nutrient management (FYM @ 15 tonnes/ha and vermicompost @ 7.5 tonnes/ha + *Azophos* @5 kg/ha)